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ODONATA OF FRIULI VENEZIA GIULIA: SECOND UPDATE OF CHECKLIST AND FURTHER REMARKS

ODONATI DEL FRIULI VENEZIA GIULIA:
SECONDO AGGIORNAMENTO DELLA CHECKLIST
E ULTERIORI OSSERVAZIONI

Abstract - Within the Project “Atlas of the Odonatofauna of the Friuli Venezia Giulia region”, additional remarks of the Odonata of the region (North-eastern Italy) was carried out in the years 2010-2014. The new data have allowed us to enrich the regional Checklist of Odonata with five species: *Chalcolestes parvidens* (ARTOBOLSKY, 1929) and *Lindenia tetraphylla* (VANDER LINDEN, 1825) that have not been observed previously in the region and *Anax ephippiger* (BURMEISTER, 1839), *Gomphus vulgatissimus* (LINNAEUS, 1758), and *Sympetrum flaveolum* (LINNAEUS, 1758) that have been detected in previous years. In addition, knowledge of the distribution of twelve species that are rare or of natural interest has been improved. At the present time the Checklist of Odonata of Friuli Venezia Giulia includes 62 species representing 66% of the Italian fauna. Two species, *L. tetraphylla* and *Cordulegaster heros* THEISCHINGER, 1979, are listed in the Annexes of the Habitats Directive. The list includes some species that have migratory tendencies and probably do not breed regularly in the region, such as *L. tetraphylla* and *A. ephippiger*. It is possible that in the near future other species might be found, some of which have already been reported for the region. Despite the considerable richness of species, we highlight a critical status for some species that are typical of mountain or alpine habitats, such as *Coenagrion hastulatum* (CHARPENTIER, 1825), *C. heros*, *Somatochlora alpestris* (SELIS 1840), *S. arctica* (ZETTERSTEDT, 1840), *Sympetrum danae* (SULZER, 1776) and *Leucorrhinia dubia* (VANDER LINDEN, 1825). In addition, *Nehalennia speciosa* (CHARPENTIER, 1840) is near extinction at the regional and national level due to the presence of just one breeding site located in a peat bog in the morainic hilly area.

Key words: Odonata, Damselflies, Dragonflies, Faunistic survey, Diversity, Conservation, North-eastern Italy.

Riassunto breve - Nell'ambito del Progetto “Atlante degli Odonati del Friuli Venezia Giulia”, negli anni 2010-2014 sono stati condotti ulteriori rilevamenti sulla fauna regionale a Odonati. Le osservazioni hanno permesso di aggiungere alla Checklist regionale degli Odonati cinque nuove specie: *Chalcolestes parvidens* (ARTOBOLSKY, 1929) e *Lindenia tetraphylla* (VANDER LINDEN, 1825) in precedenza non rilevate in regione, nonché *Anax ephippiger* (BURMEISTER, 1839), *Gomphus vulgatissimus* (LINNAEUS, 1758) e *Sympetrum flaveolum* (LINNAEUS, 1758) già osservate in anni precedenti. Inoltre, è migliorato il quadro delle conoscenze sulla distribuzione di dodici specie rare o di interesse naturalistico. Al momento attuale la Checklist degli Odonati del Friuli Venezia Giulia comprende 62 specie che rappresentano il 66% dell'odonatofauna italiana. Due specie, *L. tetraphylla* e *Cordulegaster heros* THEISCHINGER 1979, sono incluse negli allegati della Direttiva Habitat. Nell'elenco sono comprese alcune specie migranti che, probabilmente, non si riproducono regolarmente sul territorio regionale, quali *L. tetraphylla* e *A. ephippiger*. È possibile che nel prossimo futuro possano essere rinvenute altre specie, alcune delle quali già segnalate in passato per la regione. Nonostante la rilevante ricchezza di specie, si segnalano situazioni critiche relative ad alcune di esse, in particolare di ambiente montano o alpino, come *Coenagrion hastulatum* (CHARPENTIER, 1825), *C. heros*, *Somatochlora alpestris* (SELIS, 1840), *S. arctica* (ZETTERSTEDT, 1840), *Sympetrum danae* (SULZER, 1776) e *Leucorrhinia dubia* (VANDER LINDEN, 1825). Inoltre, *Nehalennia speciosa* (CHARPENTIER, 1840) appare prossima all'estinzione sul territorio regionale e nazionale, in quanto già da alcuni anni risulta presente in un unico sito riproduttivo localizzato in una torbiera nell'area collinare morenica.

Parole chiave: Odonata, Damigelle, Dragoni, Indagine faunistica, Biodiversità, Conservazione, Italia nord-orientale.

Introduction

At the end of 2011 an initial Checklist of the Odonata of the Friuli Venezia Giulia region (North-eastern Italy) was compiled on the basis of observations conducted in the years 2009-2011 by a team of observers operating in the Project “Atlas of the Odonata” in this

region (FIORENZA et al. 2012). Fifty species were recorded, which was slightly lower than the number reported many years earlier, first by KIAUTA (1969) and then by PECILE (1984). This fact can be attributed to a less rigorous observation or capture, but also to the difficulty of performing observations in the mountain sector in particular.

Additional samplings conducted in 2012 have allowed the observation of specimens belonging to new taxa for a total of 57 species (FIORENZA et al. 2013); moreover the very critical status of *Nehalennia speciosa* (CHARPENTIER, 1840) was also noted (CHIANDETTI et al. 2014).

In the years 2013 and 2014 the survey was continued. In particular, new sites with the presence of the rare species *Cordulegaster heros* THEISCHINGER, 1979 listed in the Habitats Directive (Council Directive 92/43/EEC) were identified in some areas of the Julian Pre-Alps (CHIANDETTI et al. 2013, 2015).

In this note we present the most important data collected during the last five years. In particular, the updated Checklist of Odonata species of the Friuli Venezia Giulia region is reported and the distribution of some rare species or those of natural interest is discussed.

Materials and methods

In the years 2010-2014 the observations concerning Odonata adults were carried out in different areas of the Friuli Venezia Giulia region, in particular in the mountain sector, as in the previous surveys (FIORENZA et al. 2012, 2013). Digital cameras were used extensively with the instructions to collaborators to photograph specific details useful for the identification of the different species. Capture tools for adults were used only in areas where no restrictive regulations were enacted. In the case of particularly interesting findings that, for example, involved species that had not been detected previously at sites considered new or unusual, further field research was carried out in order to confirm the results of the initial observations. Part of data collected during the years 2010-2012 were already reported in FIORENZA et al. (2012, 2013).

For the identification of adults we referred to various manuals, in particular to the volumes of DIJKSTRA & LEWINGTON (2006), GRAND & BOUDOT (2006), BELLMANN (2013) and GALLIANI et al. (2014), in addition to constant contact with experts in Odonata identification. Moreover, as comparison material, specimens already identified and present in the collections of the Dipartimento di Scienze Agrarie e Ambientali, University of Udine, or the personal collections of a number of the authors were used.

The complete database of Odonata fauna recorded in the region is regularly updated by the authors of this work and some members of the Italian society for the study and conservation of dragonflies "Odonata.it".

The following abbreviations have been used in the text: CU = Costanza Uboni; GN = Gessica Nadalon; IC = Ivan Chiandetti; TF = Tiziano Fiorenza. Administra-

tive provinces acronyms: GO = Gorizia; PN = Pordenone; TS = Trieste; UD = Udine. Other abbreviations: ad. = adult/adults, ex./exx. = specimen/specimens; exu. = exuvia/exuviae; det. = determinavit; leg. = legit; obs. = observavit/observaverunt.

Results and discussions

The updated Checklist of the Odonata of Friuli Venezia Giulia is compared with two previous lists compiled by other Authors in tab. I.

New species added to the Checklist, not previously observed in the region

Below we deal with two species new for the Checklist, which were not previously observed in the region.

Chalcolestes parvidens (ARTOBOLEVSKY, 1929)

Records: some ♂♂ and ♀♀, 25.IX.2010, Isola della Cona (Staranzano, GO) (1 m a.s.l.), wet coastal area in the Nature Reserve of the Isonzo River Mouth, CU obs. (UBONI 2011); some ♂♂ and ♀♀, 29.IX.2011, Lisert (Monfalcone, GO) (1 m a.s.l.), wet coastal area, CU obs. (UBONI et al., in prep.); some ♂♂ and ♀♀, 29.VIII.2013, Isola della Cona (Staranzano, GO), same site as before, I. Maiorano obs.; 1 ♂, 04.X.2014, Precenicco (UD) (2 m a.s.l.), along the Stella River, IC obs.

Notes: Often the species is placed in the genus *Lestes* FABRICIUS. The identification in the field of *C. parvidens* is rather difficult because of the similarity with the allied species *C. viridis* (VANDER LINDEN, 1825). Recent findings indicate the constant occurrence of the species in coastal and lowland areas of the region. *C. parvidens* is also present in several sites on the plains of the Veneto region (RISERVATO et al. 2014; DALLA VIA & ZANETTI 2015).

Lindenia tetraphylla (VANDER LINDEN, 1825)

Records: 1 ♂, 2.VI.2010 Lisert (Monfalcone, GO) (1 m a.s.l.), wet coastal area, CU obs. (UBONI et al., in prep.).

Notes: The species was also observed along the West coast of Istria (Croatia) some decades ago (KIAUTA 1963). The adult found in Friuli Venezia Giulia may be ascribed to a vagrant individual that arrived during a migration from the Balkan area. The species is not reported from the plains of the Veneto region (DALLA VIA & ZANETTI 2015). In Italy *L. tetraphylla* is localized in a few sites in some Central and Southern regions, and in Sardinia (RISERVATO et al. 2014). The species has migratory tendencies from its reproductive sites (DIJKSTRA & LEWINGTON 2006; BOUDOT et al. 2009). *L. tetraphylla* is listed in Annex II and Annex IV of the Habitats Directive.

Species	KIAUTA 1969	PECILE 1984	Remarks 2009-2014
ZYGOPTERA			
<i>Calopteryx splendens</i> (HARRIS, 1782)	X	X	X
<i>Calopteryx virgo</i> (LINNAEUS, 1758)	X	X	X
<i>Sympecma fusca</i> (VANDER LINDEN, 1820)	X	X	X
<i>Lestes barbarus</i> (FABRICIUS, 1798)	X	X	X
<i>Lestes dryas</i> KIRBY, 1890	X ⁽¹⁾		
<i>Lestes sponsa</i> (HANSEMAN, 1823)	X	X	X
<i>Chalcolestes viridis</i> (VANDER LINDEN, 1825)	X	X	X
<i>Chalcolestes parvidens</i> (ARTOBOLEVSKY, 1929)			X ⁽³⁾
<i>Platycnemis pennipes</i> (PALLAS, 1771)	X	X	X
<i>Pyrrhosoma nymphula</i> (SULZER, 1776)	X	X	X
<i>Ischnura elegans</i> (VANDER LINDEN, 1820)	X	X	X
<i>Ischnura pumilio</i> (CHARPENTIER, 1825)	X	X	X
<i>Enallagma cyathigerum</i> (CHARPENTIER, 1840)	X		X
<i>Coenagrion hastulatum</i> (CHARPENTIER, 1825)			X ⁽⁴⁾
<i>Coenagrion ornatum</i> (SELYS, 1850)	X	X	
<i>Coenagrion puella</i> (LINNAEUS, 1758)	X	X	X
<i>Coenagrion pulchellum</i> (VANDER LINDEN, 1825)	X	X	X
<i>Coenagrion scitulum</i> (RAMBUR, 1842)	X	X	X
<i>Erythromma najas</i> (HANSEMAN, 1823)	X	X	X ⁽⁴⁾
<i>Erythromma viridulum</i> (CHARPENTIER, 1840)	X	X	X
<i>Erythromma lindenii</i> (SELYS, 1840)	X	X	X
<i>Ceragrion tenellum</i> (DE VILLERS, 1789)		X	X
<i>Nehalennia speciosa</i> (CHARPENTIER, 1840)		X	X ⁽⁴⁾
ANISOPTERA			
<i>Brachytron pratense</i> (MÜLLER, 1764)	X	X	X
<i>Aeshna affinis</i> VANDER LINDEN, 1820	X	X	X
<i>Aeshna cyanea</i> (MÜLLER, 1764)	X	X	X
<i>Aeshna grandis</i> (LINNAEUS, 1758)		X	X ⁽⁴⁾
<i>Aeshna isocles</i> (MÜLLER, 1767)	X	X	X
<i>Aeshna juncea</i> (LINNAEUS, 1758)	X	X	X
<i>Aeshna mixta</i> LATREILLE, 1805	X	X	X
<i>Anax ephippiger</i> (BURMEISTER, 1839)			X ⁽³⁾
<i>Anax imperator</i> LEACH, 1815	X	X	X
<i>Anax parthenope</i> (SELYS, 1839)	X	X	X
<i>Gomphus vulgatissimus</i> (LINNAEUS, 1758)	X ⁽²⁾	X ⁽²⁾	X ⁽³⁾
<i>Onychogomphus forcipatus</i> (LINNAEUS, 1758)	X	X	X
<i>Lindenia tetraphylla</i> (VANDER LINDEN, 1825)			X ⁽³⁾
<i>Cordulegaster bidentata</i> SELYS, 1843	X	X	X
<i>Cordulegaster boltonii</i> (DONOVAN, 1807)	X	X	X
<i>Cordulegaster heros</i> THEISCHINGER, 1979			X ⁽⁴⁾
<i>Cordulia aenea</i> (LINNAEUS, 1758)	X	X	X
<i>Somatochlora alpestris</i> (SELYS, 1840)		X	X ⁽⁴⁾
<i>Somatochlora arctica</i> (ZETTERSTEDT, 1840)		X	X ⁽⁴⁾
<i>Somatochlora flavomaculata</i> (VANDER LINDEN, 1825)	X	X	X
<i>Somatochlora meridionalis</i> NIELSEN, 1935			X ⁽⁴⁾
<i>Somatochlora metallica</i> (VANDER LINDEN, 1825)	X	X	X
<i>Libellula depressa</i> LINNAEUS, 1758	X	X	X
<i>Libellula fulva</i> MÜLLER, 1764	X	X	X
<i>Libellula quadrimaculata</i> LINNAEUS, 1758	X	X	X
<i>Orthetrum albistylum</i> (SELYS, 1848)	X	X	X
<i>Orthetrum brunneum</i> (FONSCOLMBE, 1837)	X	X	X
<i>Orthetrum cancellatum</i> (LINNAEUS, 1758)	X	X	X
<i>Orthetrum coerulescens</i> (FABRICIUS, 1798)	X	X	X
<i>Crocothemis erythraea</i> (BRULLÉ, 1832)	X	X	X
<i>Sympetrum danae</i> (SULZER, 1776)		X	X ⁽⁴⁾
<i>Sympetrum depressiusculum</i> (SELYS, 1841)	X	X	X ⁽⁴⁾
<i>Sympetrum flaveolum</i> (LINNAEUS, 1758)	X	X	X ⁽³⁾
<i>Sympetrum fonscolombii</i> (SELYS, 1840)	X	X	X
<i>Sympetrum meridionale</i> (SELYS, 1841)	X	X	X
<i>Sympetrum pedemontanum</i> (ALLIONI, 1766)	X	X	X
<i>Sympetrum sanguineum</i> (MÜLLER, 1764)	X	X	X
<i>Sympetrum striolatum</i> (CHARPENTIER, 1840)	X	X	X
<i>Sympetrum vulgatum</i> (LINNAEUS, 1758)	X	X	X
<i>Leucorrhinia dubia</i> (VANDER LINDEN, 1825)		X	X ⁽⁴⁾
<i>Leucorrhinia pectoralis</i> (CHARPENTIER, 1825)	X	X	
<i>Selysiothemis nigra</i> (VANDER LINDEN, 1825)			X ⁽⁴⁾
Total species	52	55	62

1) species listed by KIAUTA (1969) on the basis of the old information of LAZZARINI (1896), recorded by TACCONI (1906) and then by BENTIVOGLIO (1908).

2) species listed by KIAUTA (1969) and PECILE (1984) on the basis of the old information of SENNA (1890), recorded by LAZZARINI (1896) and then by BENTIVOGLIO (1908), but questioned by TACCONI (1906).

3) new species found in 2013-2014 and included in the present Checklist.

4) new records of rare species or those of natural interest reported in this paper.

Tab. I - List of Odonata species of the Friuli Venezia Giulia region following KIAUTA (1969), PECILE (1984), and more recent observations (2009-2014) of adults carried out within the Project "Atlas of Odonata of the Friuli Venezia Giulia region".

- Elenco delle specie di Odonati rilevate sul territorio del Friuli Venezia Giulia sulla base di KIAUTA (1969), PECILE (1984) e delle più recenti osservazioni (2009-2014) sugli adulti condotte nell'ambito del Progetto "Atlante degli Odonati del Friuli Venezia Giulia".

New species added to Checklist, already observed in the region

Below we treat three species new for the Checklist and that had been detected in the region in previous years.

Anax ephippiger (BURMEISTER, 1839)

Records: 1 ex., 01.VIII.2010, Lisert (Monfalcone, GO) (1 m a.s.l.), wet coastal area, CU obs. (UBONI et al. in prep.).

Notes: Often the species is placed in the genus *Hemianax* BURMEISTER. Previously, the occurrence of *A. ephippiger* was also reported as occasional in the region: specimens were found near Castel Novo (Sagrado, GO) (in August 1988) and along the road between Ronchi dei Legionari and Doberdò del Lago (GO) (in September 1988) (BOGNOLO & PECILE 1995). Two specimens of *A. ephippiger*, collected by Pecile in 1988, are conserved in the collections of the Friulian Museum of Natural History in Udine (P. GLERAN, pers. comm.). In June-July 2008 the species was observed in the Nature Reserve of the Isonzo River Mouth (MEKKES 2008). The species was also observed in the Veneto plain, in particular close to the border with the Friuli Venezia Giulia region (RISERVATO et al. 2014), but in recent years the species was not found in that area (DALLA VIA & ZANETTI 2015). In Italy *A. ephippiger* has been found in many regions, but in none of these it is present with stable populations (RISERVATO et al. 2014). The species is strongly migratory from the arid regions of Africa and Asia, and occasionally spreads to Central and Northern Europe (DIJKSTRA & LEWINGTON 2006; BOUDOT 2009).

Gomphus vulgatissimus (LINNAEUS, 1758) (fig. 1)

Records: 1 ♂, 21.V.2013, Rupa (Savogna d'Isonzo, GO) (49 m a.s.l.), near the Vipacco River, CU obs.; 2 ♂♂ and 1 ♀, 10.V.2014, Peci (Savogna d'Isonzo, GO) (40 m a.s.l.), along the Vipacco River, IC obs.; 4 ♂♂ and 2 ♀♀, 11.V.2014, Muzzana del Turgnano (UD) (3 m a.s.l.), along the Cormôr River, IC obs.; some exx., 24.V.2014, Precenicco (UD) (2 m a.s.l.), along the Stella River, TF obs.

Notes: A rather curious observation of one dead specimen of this species was made in 2003 on the bodywork of a car that travelled a route in the Gorizia area (T. ZORZENON, pers. comm.). This species was reported for Lake Cavazzo and Lake Ragogna by SENNA (1890), but subsequently individuals of this species have not been found in these areas, even during a detailed survey of Lake Ragogna (PECILE 1989). In May 1986 a female was collected along the Ospo stream near Trieste (BOGNOLO & PECILE 1995); the specimen is conserved in the collections of the Friulian Museum of Natural History in Udine (P. GLERAN, pers. comm.).



Fig. 1 - Couple of *Gomphus vulgatissimus*; 10.V.2014, Muzzana del Turgnano (UD) (photo by I. Chiandetti).
- Coppia di *Gomphus vulgatissimus*; 10.V.2014, Muzzana del Turgnano (UD) (foto I. Chiandetti).



Fig. 2 - Male of *Sympetrum flaveolum*; 09.VIII.2014, Fusine (Tarvisio, UD) (photo by I. Chiandetti).
- Maschio di *Sympetrum flaveolum*; 09.VIII.2014, Fusine (Tarvisio, UD) (foto I. Chiandetti).



Fig. 3 - Couple of *Nehalennia speciosa*; 20.VI.2013, Torbiera di Lazzacco (Pagnacco, UD) (photo by I. Chiandetti).
- Coppia di *Nehalennia speciosa*; 20.VI.2013, Torbiera di Lazzacco (Pagnacco, UD) (foto I. Chiandetti).

Sympetrum flaveolum (LINNAEUS, 1758) (fig. 2)

Records: 2 ♂♂, 9.VIII.2014, Fusine (Tarvisio, UD) (847 m a.s.l.), wet meadow, IC obs.

Notes: The discovery of two individuals of *S. flaveolum* near Tarvisio in the Italian area at the Fusine pass is very interesting. The presence of adults in this site, as well as in wet grasslands in the nearby Ratece area (Slovenia), is worth further consideration in the future due to the migrations that characterize this species (DIJKSTRA & LEWINGTON 2006). These new data confirm those of CONCI (1956) (Tarvisio, 10.VII.1956, leg. C. Nielsen), KIAUTA (1969) (Valbruna, VIII.1933, leg. B. Finzi) and MINELLI (1977) for the area around Tarvisio. Three specimens of *S. flaveolum* collected by Minelli in July 1973 at Fusine are conserved in the collections of the Museum of Natural History in Verona (L. LATELLA, pers. comm.). KIAUTA (1969) also reports specimens collected at Gemona (12.VII.1968, leg. B. Kiauta). This is notable because this species is actually extremely rare and localized in the Southern side of the Italian Alps. Recently it was reported in a limited number of alpine sites in the Piedmont and Valle d'Aosta regions (RISERVATO et al. 2014). There are also some reports from Slovenia (KOTARAC 1997) and Carinthia (Austria) (HOLZINGER & KOMPOSCH 2012).

Rare species or those of natural interest confirmed in the Checklist

In the reference period, observations concerning specimens of species that are rather rare or of natural interest occurred in different sites of the region. These data confirm the inclusion of these species in the Checklist.

Coenagrion hastulatum (CHARPENTIER, 1825)

Records: some exx., 08.VII.2012, Laghetto di Somdogna (Dogna, UD) (1442 m a.s.l.), mountain pond, TF obs.; some exx., 08.VII.2012, Passo Pramollo lake (Pontebba, UD) (1522 m a.s.l.), mountain lake, TF obs. (FIORENZA et al. 2013); 2 ♂♂, 30.VI.2013, Laghetto di Somdogna (Dogna, UD), same site as before, IC obs.; 2 ♂♂, 11.VIII. 2013, Passo Pramollo (Pontebba, UD) (1522 m a.s.l.), near a mountain lake, IC obs.; 1 ♂ and 1 ♀ (in tandem), 16.VIII.2013, Malga Lussari (Malborghetto-Valbruna, UD) (1573 m a.s.l.), near a mountain pond, TF obs.; 2 ♂♂, 29.VII.2014, Passo Pramollo lake (Pontebba, UD), same site as before, TF obs.

Notes: Previously, five males of the species were observed in July 1984 near Fusine (Tarvisio, UD) by PECILE (1991). In Italy, the species is fairly common in alpine areas of Trentino Alto Adige and Veneto (RISERVATO et al. 2014).

Erythromma najas (HANSEMAN, 1823)

Records: 1 ♂, 27.VII.2013, Rutte Piccolo (Tarvisio, UD) (800 m a.s.l.), artificial pond, IC obs.

Notes: The species was reported by KIAUTA (1969) for the pond of Percedol (Monrupino, TS) in a karst area; this data was mentioned by PECILE (1984) but then questioned by BOGNOLO & PECILE (1995) because it was not possible to locate the collected specimens previously reported and also for the widespread presence of the allied species *E. viridulum* (CHARPENTIER, 1840). For the area around the mouths of the Timavo River (Trieste) *E. najas* was also reported by STAMMER (1932). In Italy, recent reports of the species are not numerous (RISERVATO et al. 2014).

Nehalennia speciosa (CHARPENTIER, 1840) (fig. 3)

Records: 5 exx., 08.V.2013, Torbiera di Lazzacco (Pagnacco, UD) (189 m a.s.l.), peat bog in the morainic hilly area, TF obs.; 10 ♂♂ (of these, two exx. during emergence), 12.V.2013, same site as before, IC obs.; 10 ♂♂ (of these, one ex. during emergence), 25.V.2013, same site as before, IC obs.; 10 ♂♂ and 5 ♀♀, 20.VI.2013, same site as before, IC obs.; 1 ex., 12.V.2014, same site as before, TF obs.; 4 ♂♂ and 1 ♀, 07.VI.2014, same site as before, IC, CU and TF obs.; 2 ♀♀, 12.VII.2014, same site as before, IC obs.

Notes: The first discovery of *N. speciosa* in Friuli Venezia Giulia occurred in 1980; it refers to the peat bog of Brazzacco (Moruzzo, UD) (PECILE 1981), in the morainic hilly area. Later, a population of the species was found in the swamp of Cima Corso (Ampezzo, UD), in the Carnic Alps (PECILE 1991). In 2009, viable populations of the species were observed only at the Cima Corso swamp and the peat bog of Lazzacco (Pagnacco, UD) (FIORENZA & PECILE 2009). In the 2010-2014 period the only occurrence of the species in the region was from the peat bog of Lazzacco (CHIANDETTI et al. 2014). Therefore, at the present time the only viable population of *N. speciosa* present in Italy is that of the peat bog of Lazzacco; the populations recorded in the Lombardy region in the 1970s are considered extinct.

Aeshna grandis (LINNAEUS, 1758)

Records: 1 ♂, 20.VIII.2011, Rifugio Nordio (Malborghetto Valbruna, UD) (1300 m a.s.l.), mountain area; IC obs.; 1 ♂, 24.VIII.2012, Val Bartolo (Tarvisio, UD) (1000 m a.s.l.), mountain area, IC obs.

Notes: The first report of *A. grandis* for Friuli Venezia Giulia was made by KIAUTA (1971) who observed one male of the species on Mount Lussari (1790 m a.s.l.) (Tarvisio, UD); then the species was observed twice in 1984 by PECILE (1991) near Fusine (880 m a.s.l.) (Tarvisio, UD). The different observations of adults (all in the mountain Tarvisio area) refer to vagrant individuals that probably do not breed in the Friuli Venezia Giulia region. The records of *A. grandis* relating to the coastal area of the region (RISERVATO et al. 2014) are likely misidentifications.

Cordulegaster heros THEISCHINGER, 1979 (fig. 4)

Records: 4 ♂♂, 29.VI.2013, Savorgnano del Torre (Povoletto, UD) (200 m a.s.l.), along a small stream tributary of the Storto stream, IC obs.; 1 ♂, 03.VII.2013, Magnano in Riviera (UD) (210 m a.s.l.), along the Bosso stream, IC obs.; 2 ♂♂, 03.VII.2013, Tarcento (UD) (255 m a.s.l.), along the Rabagnolo stream, IC obs.; 2 ♂♂ and 1 ♀, Togliano (Torreano di Cividale, UD) (255 m a.s.l.), on the bottom of a small and narrow valley called Busa di Culigna, IC obs.; 3 ♂♂, 06.VII.2013, Attimis (UD) (260 m a.s.l.), along the Musil stream, IC obs.; 1 ♂, 15.VII.2013, Bosco di Plessiva (Cormons, UD) (90 m a.s.l.), near the Fidri stream, IC obs.; 3 ♂♂ and 1 ♀ (one ex. during emergence), 11.VII.2014, Savorgnano del Torre (UD), same site as before, IC obs.

Notes: The species was observed for the first time in the Friuli Venezia Giulia region (and the first in Italy) in three streams in the Isonzo River basin in the province of Gorizia (BEDJANIČ & ŠALAMUN 2003). Later a population was found in a stream in the city of Trieste (UBONI et al. 2007). Recently, specimens of the species were observed in some streams in the basins of the Torre River, a tributary of the Isonzo River, and of the Tagliamento River (CHIANDETTI et al. 2013, 2015). *C. heros* is listed on Annex II and Annex IV of the Habitats Directive.

Somatochlora alpestris (SELYS, 1840) (fig. 5)

Records: some exx., 01.VII.2012, Laghetto di Plotta (Paluzza, UD) (1950 m a.s.l.), mountain pond, IC obs.; 1 ♂ and 2 ♀♀, 07.VII.2012, torbiera of Piani di Lanza near the Attila's cave (Paularo, UD) (1750 m a.s.l.), peat bog, IC obs.; 1 ♂, 29.VII.2012, Laghetto di Malins (Prato Carnico, UD) (1699 m a.s.l.), mountain pond, IC obs.; 1 ♂, 05.VIII.2012, torbiera near Passo Zauf (Sauris, UD) (1878 m a.s.l.), peat bog, IC obs.; 1 ♂, 06.VII.2013, in the area of Passo Pura (Ampezzo, UD) (1400 m a.s.l.), mountain pond, S. Sava obs. (S. Hardersen det.; H. Wildermuth det.); 3 ♂♂, 11.VIII.2013, wet areas between the Monte Carnizza and the Monte Corona (Pontribba, UD) (1700 m a.s.l.), mountain/alpine ponds, IC obs.

Notes: The occurrence of this species in the region was reported by PECILE (1983) for some alpine sites in the Carnic Alps (Passo Pramollo, Cason di Lanza, Torbiera under the Zuc della Guardia).

Somatochlora arctica (ZETTERSTEDT, 1840) (fig. 6)

Records: 2 ♂♂ and 1 ♀, 17.VI.2012, Palude di Cima Corso (Ampezzo, UD) (836 m a.s.l.), mountain pond, IC obs.; 1 ♂, 15.VIII.2012, Torbiera Scichizza near Fusine (Tarvisio, UD) (850 m a.s.l.), peat bog, IC obs.; 1 ♀, 09.IX.2012, same site as before, IC obs.; 1 ♂ and 1 ♀ (both ex. during emergence), 22.VI.2013, Palude di Cima Corso (Ampezzo, UD) (836 m a.s.l.), swamp area, IC obs.; 2 ♂♂ (both ex. during emergence), 09.VI.2013, Torbiera Scichizza near Fusine (Tarvisio, UD) (850 m a.s.l.), peat bog, IC obs.; 1 ♂ and 1 ♀, 23.VI.2013, same site as before, IC obs.; 1 ♂, 03.VIII.2014, same site as before, IC obs.; 1 ♂, 09.VIII.2014, same site as before, IC obs.



Fig. 4 - Male of *Cordulegaster heros*; 19.VII.2014, Savorgnano del Torre (UD) (photo by I. Chiandetti).
- *Maschio di Cordulegaster heros*; 19.VII.2014, Savorgnano del Torre (UD) (foto I. Chiandetti).



Fig. 5 - Male of *Somatochlora alpestris*; 05.VIII.2012, Peat bog near Passo Zauf (Sauris, UD) (photo by I. Chiandetti).
- *Maschio di Somatochlora alpestris*; 05.VIII.2012, torbiera presso Passo Zauf (Sauris, UD) (foto I. Chiandetti).

Notes: Adults of this species were observed in 1977-1981 by PECILE (1983) in the mountain area of Fusine (Tarvisio, UD) and in 1988 by PECILE (1991) at the Palude di Cima Corso (Ampezzo, UD). One female and one exuvia of *S. arctica* were found at the Palude di Cima Corso on 23.VI.2008 (S. HARDERSEN, pers. comm.). The sites Palude di Cima Corso (Carnic Alps) and Torbiera Scichizza (Julian Alps) are therefore important breeding sites for *S. arctica* in the mountain sector of Friuli Venezia Giulia.

Somatochlora meridionalis NIELSEN, 1935

Records: 5 ♂♂ and 7 ♀♀, 30.VI.2015, Rio Ospo (Trieste), CU obs.; 1 ♀, 08.VII.2011, Colloredo di Monte Albano (UD) (200 m a.s.l.), along a stream in the morainic hilly area, IC obs.; 1 ♂, 16.VI.2012, Torbiera del Chialcinat (Moruzzo, UD), (189 m a.s.l.), along a stream in the morainic hilly area, IC obs.; some exx., 16.VIII.2012, Savorgnano del Torre (Povoletto, UD) (185 m a.s.l.), along a small stream tributary of the Storto stream in a prealpine area, IC obs.; some exx., 21.VIII.2012, Savorgnano del Torre (Povoletto, UD) (200 m a.s.l.), along a stream in a prealpine area, IC obs.; 1 ♂, Flagogna (Forgaria



Fig. 6 - Male of *Somatochlora arctica*; 09.VI.2013, Torbiera Scichizza (Tarvisio, UD) (photo by I. Chiandetti).
- Maschio di *Somatochlora arctica*; 09.VI.2013, Torbiera Scichizza (Tarvisio, UD) (foto I. Chiandetti).



Fig. 7 - Male of *Sympetrum danae*; 27.VII.2013, Torbiera Scichizza (Tarvisio, UD) (photo by I. Chiandetti).
- Maschio di *Sympetrum danae*; 27.VII.2013, Torbiera Scichizza (Tarvisio, UD) (foto I. Chiandetti).

nel Friuli, UD) (145 m a.s.l.), along a stream in a prealpine area, IC obs.; 2 ♂♂, Pian delle Farcadizze (Faedis, UD) (650 m a.s.l.), along a stream in a prealpine area, IC obs.; 1 ♂, 08.VI.2014, Colloredo di Monte Albano (UD) (193 m a.s.l.), same site as before, IC obs.; 1 ♂, 08.VI.2014, Cormons (GO) (73 m a.s.l.), near the Fidri stream in a prealpine area, IC obs.; 1 ♂, 02.VIII.2014, Montenars (UD) (358 m a.s.l.), along a small stream tributary of the Orvenco creek in a prealpine area, IC obs.; 1 ♂, 09.VIII.2014, Bonifica dei Quattroventi

(Moruzzo, UD) (185 m a.s.l.), along a stream in the morainic hilly area, TF obs.

Notes: Adults of this species were previously observed in several sites by BOGNOLO & PECILE (1995) and UBONI (2008) in the karst area. *S. meridionalis* seems absent from the Veneto region (RISERVATO et al. 2014).

Sympetrum danae (SULZER, 1776) (fig. 7)

Records: 4 ♂♂ (of these, two exx. during emergence), 27.VII.2013, Torbiera Scichizza near Fusine (Tarvisio, UD) (850 m a.s.l.), peat bog, IC obs.; 2 ♂♂, 03.VIII.2013, same site as before, IC obs.

Notes: This alpine species was reported by MINELLI (1977) for the area of Fusine. One female of *S. danae*, collected by Minelli in July 1973 at Fusine, is conserved in the collections of the Museum of Natural History in Verona (L. LATELLA, pers. comm.).

Sympetrum depressiusculum (SELYS, 1841) (fig. 8)

Records: 1 ♂ (immature), 17.VII.2011, Magredi di Baisaldella near the Meduna River (with a typical dry gravel bed) (Vivaro, PN) (120 m a.s.l.), temporary pool, P.L. Taiariol obs.; some exx., 19.VIII.2011, Titiano (Precenico, UD) (5 m a.s.l.), plain ponds, IC obs.; some exx., 01.X.2011, Flambrò (Talmassons, UD) (30 m a.s.l.), wet area, IC obs.; some exx., 20.VII.2012, Stagno di Vivaro (Vivaro, PN) (138 m a.s.l.), plain pond, IC obs.; 1 ♂, 22.VIII.2012, Palude Vuarbis (Cavazzo Carnico, UD) (274 m a.s.l.), swamp area, IC obs.; 3 ♂♂ and 1 ♀, 23.VII.2014, Laghetti di Villanova (San Daniele del Friuli, UD) (111 m a.s.l.), ponds near the Tagliamento River, IC obs.; 2 ♂♂ and 1 ♀, 26.VII.2014, same site as before, IC obs.; 1 ♂, 31.VIII.2014, same site as before, IC obs.

Notes: This species was reported by KIAUTA (1969) from an adult collected in 1937 (leg. G. Marcuzzi) in Staranzano (GO); the specimen is preserved in the collections of the Museum of Natural History in Trieste. The species was also found in 1982 at Lake Ragogna in a morainic hilly area (PECILE 1989).

Leucorrhinia dubia (VANDER LINDEN, 1825)

Records: some ♂♂ and ♀♀ (also in tandem) and exu., 08.VII.2012, Laghetto di Somdogna (Dogna, UD) (1442 m a.s.l.), mountain pond, TF obs.; 3 ♂♂ and 1 ♀, 23.VI.2013, Laghetto di Somdogna (Dogna, UD), same site as before, IC obs.; 1 ♂ (probably vagrant), 27.VII.2013, Rutte Piccolo (Tarvisio, UD) (800 m a.s.l.), artificial pond, IC obs.; 1 ♂ (probably vagrant), 27.VII.2013, Fusine (Tarvisio, UD) (850 m a.s.l.), artificial pond, IC obs.; 1 ♂, 13.VIII.2013, Laghi di Festons (Sauris, UD) (1833 m a.s.l.), mountain ponds, IC obs.

Notes: This alpine species was found previously in a single site in the region: the surroundings of Fusine (MINELLI 1977). Two specimens of *L. dubia*, collected by Minelli in July 1973 at Fusine, are conserved in the collections of the Museum of Natural History in Verona (L. LATELLA, pers. comm.); in the same Museum



Fig. 8 - Male of *Sympetrum depressiusculum*; 23.VII.2014, Laghetti di Villanova (S. Daniele del Friuli, UD) (photo by I. Chiandetti).
- Maschio di *Sympetrum depressiusculum*; 23.VII.2014, Laghetti di Villanova (S. Daniele del Friuli, UD) (foto I. Chiandetti).



Fig. 9 - Male of *Selysiothemis nigra*; 24.VI.2015, artificial pond in the Parco delle Dote (Azzano Decimo, PN) (photo by G. Nadalon).
- Maschio di *Selysiothemis nigra*; 24.VI.2015, laghetto artificiale nel Parco delle Dote (Azzano Decimo, PN) (foto G. Nadalon).

several males and females of *L. dubia*, collected by Minelli in July 1973 at Lake D'Antorno (1800 m a.s.l.) near Misurina (BL) (Veneto region), are conserved.

Selysiothemis nigra (VANDER LINDEN, 1825) (fig. 9)

Records: numerous exx. and exu., 2013 and 2014, Azzano Decimo (PN), artificial pond in the "Parco delle Dote" (10 m a.s.l.) (adults observed also in tandem; GN obs.) (UBONI et al. 2015); 1 ex. 09.IX.2013, near Tauriano (Spilimbergo, PN) (171 m a.s.l.), artificial pond to provide water for wild fauna, TF obs.; some exx., 24.VI.2014, near Tauriano (Spilimbergo, PN), same site as before, TF obs.; 1 ex., 17.VIII.2014, Spilimbergo (PN) (132 m a.s.l.), a dead specimen near a window of Spilimbergo hospital, TF obs.

Notes: Notable is the occurrence of a reproductive population of *S. nigra* in the territory of the Pordenone district (UBONI et al. 2015), and the occurrence of adults north of the town of Tauriano (Spilimbergo,

PN), collected inside an military area in an artificial pond created for watering wild ungulates. Adults of this species have been previously reported for the Veneto and Friuli Venezia Giulia regions (ZANDIGIACOMO & BUIAN 2011). The northward extension of this species has been associated with climatic change (GROPPALI 2009; OTT 2009, 2010).

Species not found during this survey but already observed in the region

Four other species of Odonata have been reported in the past for the Friuli Venezia Giulia region (tab. II), but in the six years of the present Project (2009-2014) their occurrence in the region was not confirmed.

The species listed here have been frequently detected in neighbouring areas, such as Slovenia (KOTARAC et al. 2004), Carinthia (HOLZINGER & KOMPOSCH 2012), Veneto (BUCCIARELLI 1978; RISERVATO et al. 2014) and Trentino Alto Adige (FESTI 2012; MACAGNO et al. 2012). Therefore, it is possible that in the future specimens of these taxa will be found again in some sites of Friuli Venezia Giulia.

Final comments

Within the Project Atlas of the Odonata of Friuli Venezia Giulia, 62 species of Odonata were detected, considering *S. meridionalis* and *S. metallica* (VANDER LINDEN, 1825) as separate species. The taxa mentioned in the present Checklist represent about 66% of the species currently known in Italy, which amount to 93 (RISERVATO et al. 2014). Two species, *L. tetraphylla* and *C. heros*, are listed in Annex II and Annex IV of the Habitats Directive. The list includes some species that have tendencies to migrate over long distances from their reproductive localities and probably do not breed regularly in the region, such as *L. tetraphylla* and *A. ephippiger*.

This rich faunal context could potentially increase, not only through the discovery of species already observed in the recent or more distant past, but also with other species detected in neighbouring areas and never reported in this region. Among the latter species we mention:

- Lestes macrostigma* (EVERSMANN, 1836), a Mediterranean-Pannonian species rare and localized in Europe that could live in coastal lagoon environments;
- Aeshna caerulea* (STRÖM, 1783), common in Boreal-Alpine areas of Central Europe and known from some localities of the Trentino and Alto Adige, and which could live in mountain peat bogs (FESTI 2011; RISERVATO et al. 2014);
- Aeshna subarctica* WALKER, 1908, with Circumboreal distribution, discovered in recent years in Trentino

Species	Habitat/Locality/Area	Year of observation	References
<i>Lestes virens</i> (CHARPENTIER, 1825)	pond near Segrado (Sgonico, TS) in a karst area ponds near Lisert (Monfalcone, GO) in a coastal area	1985, 1986, 1989 1991	BOGNOLO & PECILE 1995 BOGNOLO & PECILE 1995
<i>Lestes dryas</i> KIRBY, 1890	along the Tagliamento river near S. Michele al T. (VE) pond near Segrado (Sgonico, TS) in a karst area pond near S. Lorenzo (Bagnoli della Rosandra, TS), in a karst area	n.i. 1982 1990, 1991	KIAUTA 1969 BOGNOLO & PECILE 1995 BOGNOLO & PECILE 1995
<i>Coenagrion ornatum</i> (SELYS, 1850)	"häufiger in den Lagunen von Monfalcone; Mai bis Juli" Triest (J. Staudacher leg.) ⁽¹⁾ near Fusine (Tarvisio, UD)	n.i. 1944 n.i.	STROBL 1906 (see also KIAUTA 1969) KIAUTA 1969; see also BOGNOLO & PECILE 1995 PECILE 1984
<i>Leucorrhinia pectoralis</i> (CHARPENTIER, 1825)	pond of Percedol (TS) (E. Stolfi leg.) in a karst area small lake at Ospedaletto (or Laghetto Minisini) (Gemona del Friuli, UD) (two exx. in tandem)	1928 1982	KIAUTA 1969; BOGNOLO & PECILE 1995 PECILE 1983

1) One male, collected 27.VI.1944, is conserved in the collections of the Slovenian Museum of Natural History in Ljubljana.

Tab. II - Species not found in this survey, but already observed in the Friuli Venezia Giulia region (n.i. = year not indicated).

- Specie non rilevate nella presente indagine, ma già osservate in Friuli Venezia Giulia (n.i. = anno non indicato).

and Alto Adige (FESTI 2011) and potentially present in some bogs of the Carnian mountain area.

It is possible that the valuable environments of water resurgence of the Friulian plain could include further species, such as *Gomphus flavipes* (CHARPENTIER, 1825) and *Ophiogomphus cecilia* (FURCROY, 1785), known from plains habitats in several areas of the Po valley (RISERVATO et al. 2014).

However, some species are localized in very small areas, which are often at risk of substantial alterations for anthropic intervention or significant changes in the climate. In particular, some mountain species associated with wetlands, such as *C. hastulatum*, *S. alpestris*, *S. arctica*, *S. danae* and *L. dubia* seem endangered.

Some threats that may affect the presence and spread of *C. heros* have been described (CHIANDETTI et al. 2015). The species *N. speciosa*, close to extinction at the regional and national level, is currently known from a single reproductive site in the area of the morainic amphitheatre of the Tagliamento River, whose population can be estimated (in 2014) as a few dozen adults (CHIANDETTI et al. 2014).

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